ROPALIDIA PLEBEIANA RICHARDS (HYMENOPTERA: VESPIDAE) IN CANBERRA

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Abstract

Ropalidia plebeiana Richards is recorded from Canberra for the first time. The presence of many nests during the summer of 1991/1992 suggests that the wasps have been established in Canberra since well before 1990 when a nest was discovered for the first time. While the species is known to make huge nest aggregations in the south-eastern coastal area of New South Wales, it does not make such nest aggregations in Canberra. Details of nest architecture in the Canberra population are described.

Introduction

The main, inland area of the Australian Capital Territory (ACT) which includes Canberra and its suburbs, has a cooler climate than the south-eastern coastal region of Australia, because of its higher elevation. Three eusocial wasp species have so far been recorded from inland ACT, i.e., two native paper wasps (*Polistes humilis* (Fabricius) and *P. erythrinus* Holmgren) (Richards, 1978) and the accidentally introduced European wasp (*Vespula germanica* (Fabricius)) (Spradbery and Maywald, 1992). Richards (1978) and Cardale (1985) recorded *Ropalidia plebeiana* from the ACT, but these records were from Jervis Bay, a part of the ACT located on the south-eastern coast of Australia, where *R. plebeiana* is known to make huge nesting aggregations (Richards, 1978; Itô *et al.*, 1988).

Although the Australian National Insect Collection (ANIC) of CSIRO has the best representative collection of Australian wasps, we could not find any *Ropalidia* wasps from Canberra in the collection. This paper records details of *Ropalidia plebeiana* and its nests in Canberra for the first time.

The First Record of Ropalidia plebeiana in Canberra and Distribution of Colonies around CSIRO, Black Mountain

In 1990, JPS found a nest of *Ropalidia plebeiana* under the eaves of the photographic building at CSIRO Division of Entomology, Black Mountain. The colony was discovered on 10.xi.1990, when it consisted of one founding female on a nest of 16 cells, each containing an egg, and 1 cell base. The colony eventually produced 3 adult females, but only one wasp remained when JPS collected it for identification on 5 January 1991. The nest was placed in ANIC with the label "*Ropalidia plebeiana* Richards nest, building No 109 CSIRO Entomology Black Mountain, Canberra, ACT Collected 27 May 1991 by J. P. Spradbery".

In the spring of 1991, JPS located 3 nests under the eaves of the same building. During his stay in Canberra between mid January and mid March 1992, JK made an intensive search for *R. plebeiana* colonies around the buildings of CSIRO Division of Entomology, Black Mountain, and some of

the buildings on the campus of the Australian National University (ANU) located opposite.

While JK did not find any additional nests at CSIRO, he found a number of nests on the campus of the ANU (Fig. 1). On a Norway spruce (*Picea abies* Karst.) in the garden of Bruce Hall, a residential college of the ANU, there were at least 24 nests (Fig. 2).

Although there were no records of *R. plebeiana* in Canberra before the nest was found in 1990, the presence of so many nests (including large old ones) in the summer of 1991/1992 suggested that the wasps have been established in Canberra since well before 1990. Further intensive investigation of colony distribution in Canberra would be required to determine whether *R. plebeiana* was a relatively recent, accidental introduction into the area around Black Mountain, or if it is endemic to the Canberra area.

Nest Architecture

Richards (1978) briefly noted the architecture of nest aggregations in the south-eastern coastal region of New South Wales, and Itô (1985) described a nest of *R. plebeiana* in Brisbane. We describe here the nest architecture and some nest construction behaviour based on observations of nests in the Canberra population, where wasps do not apparently make nest aggregations.

Substrate. Of 101 nests examined, 61 were made on the surface of artificial constructions, such as buildings. The wasps did not show a preference for particular substrates: they made nests on painted wooden walls or cornices (29 nests), bricks (14 nests), and concrete surfaces (18 nests). The wasps nested both on vertical surfaces (43 nests), and the underside of horizontal surfaces (17 nests), of which 15 were on concrete surfaces. The one remaining nest was made under an oblique concrete surface.

The remaining 40 nests were found on plants, of which 24 were on the branches of a Norway spruce in the garden of Bruce Hall. Various plant species were used as the nest substrate, but in all cases nests were made on twigs or main shoots of the plants. In no case were nests made under a broad leaf or at the apex of a needle leaf of the coniferous tree.

Nest petiole. The nest was suspended from a single, main petiole although in large nests, especially where the nest was built under a horizontal surface, some additional, subsidiary petioles were made. The basic structure of the petiole was similar to those found in paper wasps which build a "secretion petiole"; the petiole had a central core made of plant fibers (nest carton) mixed with a small amount of oral secretion, and was subsequently thickened and strengthened by the repeated coating of oral secretions. In large nests, however, the petiole was thickened by the application of plant fibers to the petiole surface in fine striae running longitudinally, and then coated with oral secretion. Thus, the petiole (except those of recently initiated nests) was smooth and dark brown in colour. The primary, main

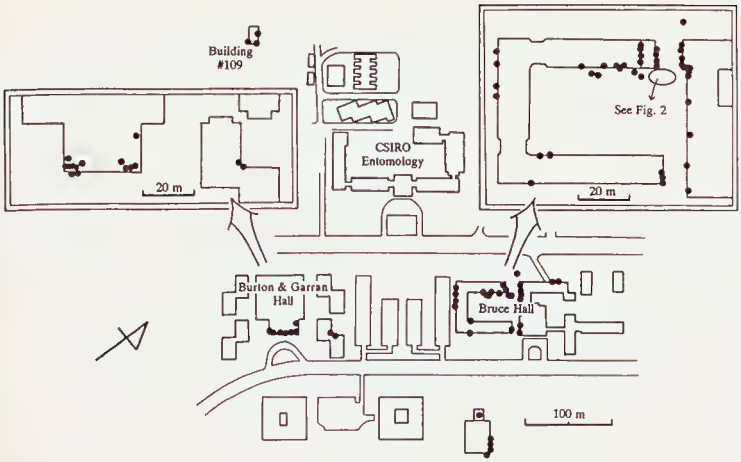

Fig. 1. Distribution of *Ropalidia plebeiana* nests in and around CSIRO Division of Entomology, Black Mountain, in the summer of 1991/1992.

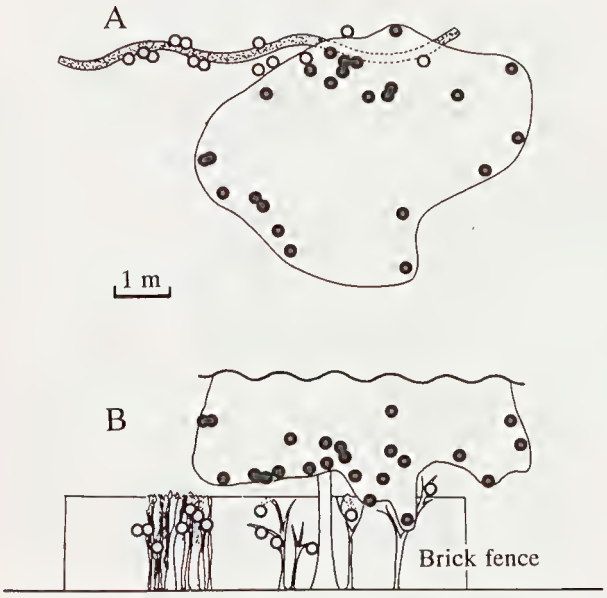

Fig. 2. Distribution of *Ropalidia plebeiana* nests on and near the Norway spruce in the garden of Bruce Hall, Australian National University, in the summer of 1991/1992. A, view from above; B, lateral view.

petiole was 2.85±0.09 mm (x±SE, n=14; range 2.4-3.5 mm) in length, and tended to become thicker in larger nests (0.4 x 0.6 mm in a nest with 13 shallow cells and 1.9 x 3.2 mm in a ca. 260 cell nest, n=14). Subsidiary petioles were generally longer (3.8-5.4 mm, n=3) than the main petiole. In some large nests on the spruce tree, a few needle leaves were connected to the comb with oral secretion or plant fibers, and then heavily coated with the oral secretion.

Shape of cells. The first cell was constructed at the apex of the petiole, and the second and further cells were made laterally on the wall of the adjacent, preformed cells, with the petiole located at the base of the first cell. Cells were regularly arranged, with an hexagonal opening when they were surrounded by other cells. The distance between the opposite sides of a completed cell was 3.89±0.02 mm (n=87; range 3.4-4.3 mm) at the rim and 3.17±0.03 mm (n=62; range 2.6-3.7 mm) at the base, with a cell depth of 12.70±0.18 mm (n=49; 8.7-15.1 mm).

Cocoon caps. Cocoon caps were slightly domed, not produced beyond the level of the rim of cell, light brown or nearly white in colour when they were just spun, then became gradually darker to brown or dark brown with age. Cocoon caps in pre-emergence nests sometimes had streaks of nest carton, but such carton application was not observed in post-emergence nests. Cocoon caps often had small central holes (diameter 0.9-1.0 mm) as reported by Itô (1985).

Semitransparent windows at the cell base. Females of all Old World polistines (*Ropalidia* Guérin-Méneville, *Parapolybia* Bingham, *Belonogaster* de Saussure and *Polybioides* du Buysson) extract the larval peritrophic sac through a hole made at the cell base. In *Ropalidia* and *Parapolybia*, these holes are later closed with an adult oral secretion, leaving semitransparent "windows" (van der Vecht, 1962; Kojima, 1983, 1992). However, the procedure of hole closure has not previously been documented. We observed the procedure on nest-18 as described below.

Closure of the hole was begun by applying the oral secretion to the edge of the hole soon after a female had extracted the meconium. Either the individual which extracted the meconium or another individual performed the closure. When an adult female started to apply oral secretion, the larva in the cell closed the hole with the caudal part of its body. The adult female then licked the hole to extend the oral secretion over the exposed larval extremity. After continuous application of the oral secretion for 4-5 minutes, the hole was completely sealed with a semitransparent membranous film.

Comb. Comb shape was quite variable; usually oval, and sometimes with extending lobes; but in no case were combs slender with cells arranged in one or two vertical rows as observed in *R. revolutionalis* (Hook and Evans, 1982). In all nests made on flat surfaces, such as walls of buildings, the

combs were parallel to the substrate surface; when a nest was made at the corner of a building under the eaves, the nest was sometimes built in the form of a right angle at the corner. Walls of a cell were usually reduced in depth after evacuation of the cell, and large nests (possibly reutilized ones) sometimes had irregular structures indicating that a part of the comb had been cut off.

Acknowledgments

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References

CARDALE, J. 1985. Vespoidea & Sphecoidea. In *Zoological Catalogue of Australia*. Vol. 2 Hymenoptera. Australian Government Publishing Service, Canberra.

HOOK, A. and EVANS, H.E. 1982. Observations on the nesting behaviour of three species of *Ropalidia* Guérin-Méneville (Hymenoptera: Vespidae). *Journal of the Australian Entomological Society* **21:** 271-275.

ITÔ, Y. 1985. Social behaviour of an Australian paper wasp, *Ropalidia plebeiana*, with special reference to the process of acceptance of an alien female. *Journal of Ethology* **3:** 21-25.

ITÔ, Y., YAMANE, S. and SPRADBERY, J.P. 1988. Population consequences of huge nesting aggregations of *Ropalidia plebeiana* (Hymenoptera: Vespidae). *Researches on Population Ecology* **30:** 279-295.

KOJIMA, J. 1983. Peritrophic sac extraction in *Ropalidia fasciata* (Hymenoptera, Vespidae). *Kontyû* **51:** 158-159.

KOJIMA, J. 1992. Temporal relationships of rubbing behavior with foraging and petiole enlargement in *Parapolybia indica* (Hymenoptera: Vespidae). *Insectes Sociaux* **39:** 275-284.

RICHARDS, O.W. 1978. The Australian social wasps (Hymenoptera: Vespidae). *Australian Journal of Zoology, Supplementary Series* **61:** 1-132.

SPRADBERY, J.P. and MAYWALD, G.F. 1992. The distribution of the European or German wasp, *Vespula germanica* (F.) (Hymenoptera: Vespidae), in Australia: past, present and future. *Australian Journal of Zoology* **40:** 495-510.

Van der VECHT, J. 1962. The Indo-Australian species of the genus *Ropalidia* (*Icaria*) (Hymenoptera, Vespidae) (second part). *Zoologische Verhandelingen, Leiden* **57:** 1-72.